Some meteorologists have asserted that the south-west monsoon may be considered a stationary cyclone. This might be so if we define a cyclone simply as an irregularly circular area of low pressure round and into which the wind blows spirally. But when we look at the kind of rain and varieties of cloud which give distinctive character to various parts of a cyclone, our own observations and the information we have received from others entirely discountenance this idea.

In Malaysia, between Singapore and Borneo, in the early days of April the surface-winds were all from about north-east, and the clouds at various levels always from more south of east. In North Borneo, later in the month, the south-west land breeze of the morning always went round by south-east to north-east in the afternoon and evening, while the higher clouds came always from about north-east.

In Sooloo and the Philippines during the month of May the surface winds were much complicated by land and sea breezes, but the sequence of upper currents was always that proper to the hemisphere.

So far for ordinary weather. I was not fortunate enough to meet with a typhoon, but the reports of the observatories at Manilla, Hong Kong, and Tokio are all agreed that the relation of upper and lower currents is the same in a typhoon in the China Seas as in a European cyclone.

Yokohama, June 12 RALPH ABERCROMBY

Mock Sun

I INCLOSE sketch of the first mock sun I have been fortunate enough to see at Cranbrook, Kent, on July 20, 5 to $5\frac{1}{2}$ p.m.

About 10m. before noticing this fine phenomenon we had noticed a fragment of it, not knowing what was to follow; and we were struck by the extraordinary position of the bow with reference to the sun, viz. about 45° from it, and at an unaccountable angle to the horizon. The latter picture I can only draw by memory. The upper drawing is from one made on the spot in presence of two intelligent adult witnesses, who were consulted on each point which I proceed to notice.

(1) The rainbow near the zenith was of the breadth and brilliancy of an ordinary rainbow (the same was the case with the fragment seen ten minutes earlier, which was lost when the rest came out). The fact of the arc seen near the zenith belonging to two circles, one small and one large, touching each other, was sufficiently certain to my eye, confirmed by another educated eye, but not admitted by the third less educated one. I draw it as I apprehended it. The colours were unusually vivid against a thin veil of fleecy clouds.

(2) The halo-circle round the sun, and the arched eyebrows, so to call them, were about half the breadth of the rainbow, and washy in colour. The shapes drawn are quite faithful, and were so sharp as to leave no room whatever for doubt or imagination.

(3) The interior area of the circle was darker than the ouside.

(4) The position of the mock sun was not diametrical. The sun, seen through a handkerchief whose edge was stretched through the two mocks, was about two-thirds of its own breadth below the edge, clear.

(5) The white rays (about half the breadth of the mock lights) were seldom seen both at the same time, but were quite decided outside the circle and traceable within it, but nowhere nearly so bright as the mock lights.

(6) The mock lights were short fragments of arcs of rainbows, more vividly coloured than the halo-circle outside of which they stood clear of it, but not so broad and not quite so vivid as the great rainbow arc.

These fragments were *not* tangential. Short as they were, their own axis was clearly determined by all three witnesses to be inclined towards the radial ray, and more inclined to the arc of the halo. But I have unconsciously given a curved shape to the short fragment. It was too short to show a curve. There was no pretence of a disk, as if really a mock sun. It was only a very vivid fragment of a rainbow. A third fainter one was at the top of the halo.

The sky was much covered with thin cirrus; a fine sunny evening; air peculiarly clear for distant views.

Collingwood, July 22 W. J. HERSCHEL

P.S.—Radius of halo-circle, measured as best I could, $22\frac{1}{2}°$ $\pm 2\frac{1}{2}°$. Radius, continued to the rainbow, 45° with proportionate error. The arc of the halo-circle was generally absent next to the mock lights, but could sometimes be traced.

"The Duration of Germ-Life in Water"

IN a letter bearing this title in your last issue (p. 265) Mr. Downes refers to the recent publication by Messrs. Crookes, Odling, and Tidy, of some experiments which they have made on the vitality of the *Bacillus anthracis* in water, with regard to which I should like to call attention to the fact that this subject has during the past three years been investigated by various experimenters, including Koch, Cornil, and Babes, Nicati and Rietsch. Within the past two months no less than three papers have been published on this subject, two of them in Germany by Dr. Wolfhügel and Meade Bolton respectively, whilst the third, by myself, "On the Multiplication of Micro-organisms," was communicated to the Royal Society at the meeting in June last. In this paper I have recorded a number of experiments made both with the mixtures of organisms found in various natural waters, as well as with three well-characterised forms which are associated with disease, viz. Koch's "Comma" spirillum of Asiatic cholera, Finkler-Prior's "Comma" spirillum of European cholera, and the Bacillus pyocyaneus, which produces the greenish-blue colouring matter frequently present in abscesses. The methods of research which have been independently selected both by Wolfhügel, Meade Bolton, and myself, are identical, and consist in the examination, by gelatine plate-cultivation, of waters purposely impregnated with the organisms in question. This method is obviously the one which most recommends itself for the purpose, as it not only enables one to ascertain the presence or absence of the organisms, but also to quantitatively follow their multiplication or reduction. I may mention that these three organisms present great differences in their behaviour under similar circumstances; thus the *Bacillus pyocyaneus* is possessed of far greater vitality in water than either of the other two, its presence being demonstrable even in distilled water after fifty-three days, in numbers exceeding manyfold those originally introduced. Koch's "Comma" spirillum, on the other hand, was in the purest forms of potable water no longer demonstrable after the ninth day, whilst in London sewage it was found in largely multiplied numbers after twenty-nine days; whilst Finkler's spirillum could in no case be detected after the first day, and frequently not even on the day of inoculation. A curious phenomenon, which my experiments, as well as those of Wolfhügel and Meade Bolton have brought to light, is that when organisms of this kind, which are not the natural inhabitants of water, are introduced into this medium, a large proportion of them are frequently at first destroyed, a greater or less multiplication in their numbers often subsequently taking place.

The *Bacillus anthracis*, as is well known to bacteriologists, appears in two very distinct forms, the *bacillus*-form and the *spore*-form, and these present very great differences in their powers of endurance, the former being destroyed with comparative ease, whilst the spores are remarkable for their vitality. Mr. Crookes and his colleagues have apparently experimented with the bacillus-form of anthrax only, which they state is rapidly destroyed when introduced into London water, but Dr. Meade Bolton, who has dealt with anthrax in both its forms, has shown that the spores of anthrax retain their vitality even in distilled water for upwards of ninety days, and that it is only the bacilli which rapidly perish in some kinds of potable water. In polluted well-water Meade Bolton has also shown that even the bacilli are persistent for upwards of ninety days, and the spores for nearly a year, whilst Wolfhügel has found that in polluted river-water (the River Panke, in Berlin), even when diluted tenfold with distilled water, the anthrax bacilli undergo extensive multiplication. PERCY F. FRANKLAND

Normal School of Science,
South Kensington Museum, S.W., July 26

Animal Intelligence

IN NATURE for July 22, on p. 265, Mr. Frederick Lewis calls attention to a nest-building wasp who closed up her nest without filling it first with grubs or laying an egg. There is nothing uncommon in this neglect on the part of the wasp, as any one who has at all studied their habits in the tropics will know, such perfectly empty nests being frequently met with. I have often thought the empty nest might have something to do with the fact that the wasp may not have been prepared to deposit her egg; but then, if that were the case, we should occasionally find nests with the remains of the caterpillars or

spiders collected. When a wasp has once chosen a site for building, it is very difficult to drive her away.

63, St. George Street, Leeds HY. LING ROTH

The Microscope as a Refractor

I AM rather surprised, after the judicious remarks of Dr. Gladstone on this subject in NATURE of July 1 (p. 192), to find Mr. Gordon Thompson still maintaining his opinion to have introduced anything not yet known or tried with the microscope adapted to this purpose. If he had had time to go over the papers of Royston Pigott (*Proceedings* of the Royal Society, 1876), of Mr. Sorby (*Mineralogical Magazine*, 1878), and of myself (*Proceedings* of the Royal Society, 1884), he could have convinced himself that all what he proposes has been already elaborated and applied. He could also have learnt why the method with the microscope is limited in its exactitude to the third decimal, as the mathematical expression which it involves is deduced from not very strict principles, this being as well the case with the formula for the hollow prism.

The Hague, July 21 L. BLEEKRODE

HERRMANN ABICH

AS briefly reported in NATURE last week this venerable geologist died at Vienna on July 1. As far back as the year 1831 he began his scientific career by the publication of an important memoir, in which by novel methods of chemical analysis he determined the composition of various minerals of the Spinel family, and showed how alike by chemical composition and crystalline form they could all be ranged in one group. This early paper gave evidence of the carefulness of observation which distinguished him through life. It was followed by other chemical and mineralogical essays, especially in the department of volcanic products. Gradually he was led to devote special attention to the phenomena of volcanic action, and in the course of his investigations to visit most of the volcanic districts of Europe. His folio atlas of views illustrative of Vesuvius and Etna (1837), and his "Vulkanische Bildungen" (1841), are among the best known of his writings. He had great facility as a sketcher, and some of his drawings of volcanic craters have done duty for nearly half a century in text-books in many languages. The east of Europe presented a wide and almost unknown field for his exploration. As far back as 1840 he published notices of his wanderings in the Caucasus. He ascended to the summit of Mount Ararat, and devoted most of the remainder of his life to the investigation of the vast region of the Caucasus and south-eastern Europe. Many papers published from time to time in the scientific journals record his unwearied industry. But perhaps the most striking and durable monument of his scientific achievements is his great work, "Geologische Forschungen in den Kaukasischen Ländern," the publication of which he was superintending at the time of his death. This magnificent monograph, of which only the first part has been published, brings before the reader in a series of maps, sketches, large panoramic views, and detailed descriptions a picture of the external aspect and geological structure of the Caucasian region and impresses him with a profound admiration for the author's geological prowess. Abich had during the last few years settled in Vienna, availing himself of the typographic facilities to be found in the Austrian capital. He has been a notable instance of the longevity attained by many active field-geologists, for he almost reached the age of three score and ten years, retaining to the end his enthusiasm and industry. It is to be hoped that the second part of his monumental work, which is to treat of the eastern half of the Armenian Highlands, has been left in such a state as to admit of publication.

CAPILLARY ATTRACTION[1]

II.

NOW in this second way we have, in performing the folding motion, allowed the water surface to become less by 60 square centimetres. It is easily seen that, provided the radius of curvature in every part of the surface exceeds one or two hundred times the extent of distance to which the molecular attraction is sensible, or, as we may say practically, provided the radius of curvature is everwhere greater than 5000 micro-millimetres (that is, the two-hundredth of a millimetre), we should have obtained this amount of work with the same diminution of water-surface, however performed. Hence our result is that we have found 4·5/60 (or 3/40) of a centimetre-gramme of work per square centimetre of diminution of surface. This is precisely the result we should have had if the water had been absolutely deprived of the attractive force between water and water, and its whole surface had been coated over with an infinitely thin contractile film possessing a uniform contractile force of 3/40 of a gramme weight, or 75 milligrammes, per lineal centimetre.

It is now convenient to keep to our ideal film, and give

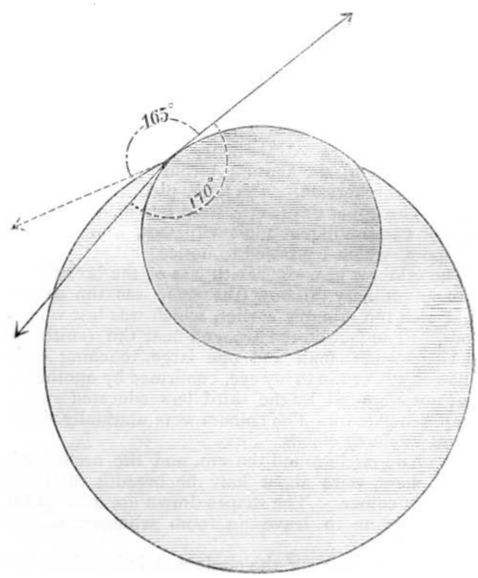

FIG. 2.

up thinking of what, according to our present capacity for imagining molecular action, is the more real thing—namely, the mutual attraction between the different portions of the liquid. But do not, I entreat you, fall into the paradoxical habit of thinking of the surface film as other than an ideal way of stating the resultant effect of mutual attraction between the different portions of the fluid. Look, now, at one of the pieces of water ideally rigidified, or, if you please, at the two pieces put together to make one. Remember we are at the centre of the earth. What will take place if this piece of matter resting in the air before you suddenly ceases to be rigid? Imagine it, as I have said, to be enclosed in a film everywhere tending to contract with a force equal to 3/40 of a gramme or 75 milligrammes weight per lineal centimetre. This contractile film will clearly press most where the convexity is greatest. A very elementary piece of mathematics tells us that on the rigid convex surface which you see, the amount of its pressure per square centimetre will be found by multiplying the sum[2] of the curvatures in two mutually-perpendicular normal sections

[1] Continued from p. 272.

[2] This sum for brevity I henceforth call simply "the curvature of the surface" at any point.